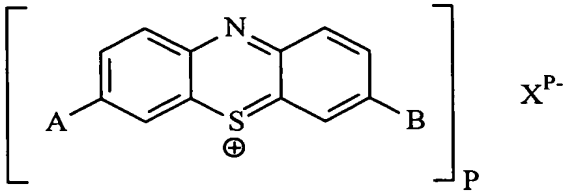
CLAIMS

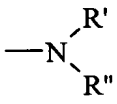
1. A phenothiazinium compound of Formula (I):



(I)

wherein:

A and B each independently is

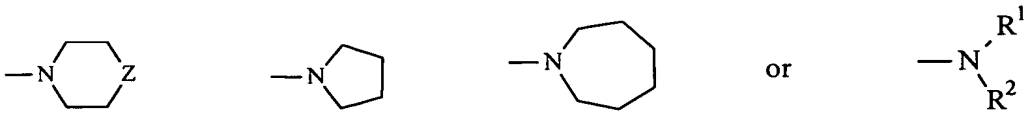


in which R' and R'' each independently is an optionally substituted linear, branched or cyclic hydrocarbon group, or R' and R'' together with the N atom to which they are attached form an optionally substituted 5-, 6- or 7-membered ring;

and where X^{P-} is a counteranion and P is 1, 2 or 3;

except for the compounds in which A and B are both either $-N(CH_3)_2$ or $-N(CH_2CH_3)_2$ for use in a treatment that requires removal, deactivation or killing of unwanted tissues or cells.

2. Use of a phenothiazinium compound according to Claim 1 in which A and B are each independently selected from



in which Z is CH_2, CH_2-C_{1-6}-alkyl, O, S, SO_2, NH, NCH_3, NC_2H_5, NCH_2CH_2OH, or $NCOCH_3$ and R^1 and R^2 are each independently linear or branched $C_nH_{2n}Y$, where n is 1-10, Y is H, F, Cl, Br, I, -OH, $-OCH_3$, $-OC_2H_5$, $-OC_3H_7$, -CN or $-OCOCH_3$.

3. Use of a compound according to Claim 1 wherein the counteranion is selected from any of F^-, Br^- Cl^-, I^-, NO_3^-, SCN^-, ClO_3^-, ClO_4^-, IO_3^-, BF_4^-, HSO_4^-, $H_2PO_4^-$, $CH_3SO_4^-$, N_3^-, SO_4^{2-}, HPO_4^{2-}, PO_4^{3-}, acetate, lactate, citrate, tartrate, glycolate, glycerate, glutamate, β-hydroxyglutamate, glucouronate, gluconate, malate and aspartate.

4. Use of a compound according to claim 1 wherein the counteranion is selected from any of Cl^-, Br^-, I^-, F^-, NO_3^-, HSO_4^-, $CH_3CO_2^-$, or a dianion, namely, SO_4^{2-} or H. PO_4^{2-}, or a trianion namely PO_4^{3-}.

5. Use of a compound according to Claim 2 in which A and B may be the same or different and R^1 and R^2 are selected independently from ethyl, n-propyl, n-butyl, i-butyl, n-pentyl, i-pentyl, n-hexyl, $HO(CH_2)_2$-, 2-ethylpiperidino, 2-methylpyrrolidino and cyclohexyl.

6. Use of a compound according to Claim 2 in which A and B may be the same or different and R^1 and R^2 are selected independently from ethyl, n-propyl, n-butyl, i-butyl, n-pentyl, i-pentyl, n-hexyl, 2-ethylpiperidino, 2-methylpyrrolidino and cyclohexyl.

7. Use of a compound according to Claim 2 in which A and B may be the same or different and R^1 and R^2 are selected independently from ethyl, n-butyl, i-butyl, n-pentyl, i-pentyl, n-hexyl, 2-ethylpiperidino, 2-methylpyrrolidino and cyclohexyl.

8. Use of a compound according to claim 1 wherein A and B are the same and both R^1 and R^2 are n-propyl, n-butyl or n-pentyl.

9. Use of the following moieties:

3,7-(tetra-n-propylamino)-phenothiazin-5-ium;

3,7-(tetra-n-butylamino)-phenothiazin-5-ium;

3,7-(tetra-n-pentylamino)-phenothiazin-5-ium;

3,7-(tetra-iso-pentylamino)-phenothiazin-5-ium;

3-(N,N-di-n-butylamino)-7-(N,N-di-n-propylamino)-phenothiazin-5-ium;

3-(N,N-di-n-hexylamino)-7-(N,N-di-n-propylamino)-phenothiazin-5-ium;

3-(2-ethylpiperidino)-7-(N,N-di-n-pentylamino)-phenothiazin-5-ium;

3-(2-methylpyrrolidino)-7-(N,N-di-n-pentylamino)-phenothiazin-5-ium;

3,7-(N,N-tetra- iso-butylamino)-phenothiazin-5-ium;

3-(N,N-di-n-butylamino)-7-(N,N-di-iso-pentylamino)-phenothiazin-5-ium;

3-(N,N-diethanolamino)-7-(N,N-di-n-pentylamino)-phenothiazin-5-ium;

3-(N,N-diethylamino)-7-(N,N-di-n-propylamino)-phenothiazin-5-ium;

3-(N,N-di-n-pentylamino)-7-(N,N-di-n-propylamino)-phenothiazin-5-ium;

3-(N,N-di-n-butylamino)-7-(N,N-di-n-pentylamino)-phenothiazin-5-ium; and

3-((N-ethyl-N-cyclohexyl) amino)-7((-N–ethyl)-N-cyclohexyl) amino-phenothiazin-5-ium;

in which the counteranions are selected from Cl^-, Br^- or I^- in a treatment that requires removal, deactivation or killing of unwanted tissues or cells.

10. A composition comprising one or more compounds of Formula I according to claims 1 to 9 together with a diluent or excipient.

11. A compound according to any of claims 1 to 9 for use as a medicament

12. A compound according to any of claims 1 to 9 for use as an anticancer agent, an antibacterial or an antifungal or an antiviral.

12. A compound according to any of claims 1 to 9 for use against microorganisms.

13. A compound according to any of claims 1 to 9 for use against bacteria.

14. A compound according to any of claims 1 to 9 for use against antibiotic resistant bacteria.

15. A compound according to any of claims 1 to 9 for use as a PDT agent or a photodiagnostic agent.

16. A compound according to any of claims 1 to 9 for use as an anti-microbial treatment for skin and other local infections, for sterilisation of burn wounds and other lesions, and for the treatment of dental bacterial disease.

17. A compound according to any of claims 1 to 9 for use in the treatment of pre-cancerous conditions, cancer, ophthalmological disease including macular degeneration, vascular problems such as cardiovascular disease, arteriosclerosis and restenosis and autoimmune diseases such as rheumatoid arthritis, skin diseases such as psoriasis, acne and excema and other benign conditions such as endometriosis and menorrhagia.

18. A compound according to any of claims 1 to 9 for use as a photoactivated antimicrobial agent for sterilisation of surfaces and fluids.

19. A compound according to any of claims 1 to 9 for use in photochemical internalisation.

20. A compound according to any of claims 1 to 9 for use in photodetection and/or photodiagnosis.

21. A conjugate or composite formed between a compound of Formula I according to claims 1 to 9 and a polymer.

22. A conjugate or composite of claim 21 wherein the polymer includes anhydride and/or ester groups.

23. A compound formed by the reaction between a compound Formula I according to claims 1 to 9 and a chlorotriazine derivative.

24. A compound according to claim 23 wherein the chlorotriazine derivative is a polymer having chlorotriazine groups attached thereto.

25. A composition comprising a compound, conjugate or composite of any of claims 21 to 24 together with a diluent or excipient.

26. A method of treating pre-cancerous conditions, cancer, ophthalmological disease including macular degeneration, vascular problems such as cardiovascular disease, arteriosclerosis and restenosis and autoimmune diseases such as rheumatoid arthritis, skin diseases such as psoriasis, acne and excema and other benign conditions such as endometriosis and menorrhagia, the method comprising administering to a subject a therapeutically effective amount of a compound of any of claims 1 to 9 and exposing said subject to light to render active said compound.

27. A method according to claim 26 wherein the compound of any of claims 1 to 9 is administered and the light exposure is given up to 48 hours after a drug is initially administered.

28. A method according to claim 26 wherein the compound of any of claims 1 to 9 is administered and the light exposure is given up to 3 hours after a drug is initially administered.

29. A method according to claim 26 wherein said compound administered is as defined in claim 8 where R^1 and R^2 are n-propyl and said light exposure is given up to 10 minutes after a drug is initially administered.

30. A method according to any one of claims 28 and 29 wherein light exposure is given within 1 minute after a drug is initially administered.

31. A method according to to any one of claims 28 and 29 wherein light exposure is given at the point of drug administration.

32. A method according to claim 26 wherein the compound administered is as defined in claim 8 where R^1 and R^2 are n-pentyl and said light exposure is given up to one hour after a drug is initially administered.

33. A method of treatment of microbial infections, burn wounds and other lesions and of dental bacterial disease, the method comprising systemic administration or applying to the area to be treated a therapeutically effective amount of a compound of any of claims 1 to 9 and exposing said area to light to render active said compound.

34. A method according to claim 33 wherein the compound administered is as defined in claim 8 where R^1 and R^2 are n-butyl.

35. A method of sterilising a surface or a fluid comprising contacting or applying the compound according to any of claims 1 to 9 to said surface or fluid and activating said compound by means of light.

36. An article having at least one surface to which is attached a compound, conjugate or composite according to any of claims 1 to 9, 21, 22, 23 and 24..

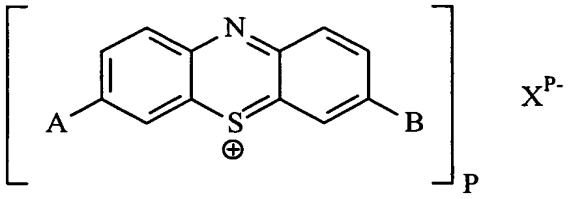
37. An article according to claim 36 wherein attachment is by covalent bonds or by intermolecular interactions.

38. An article according to claim 36 or claim 37 which is a medical device.

39 An article according to claim 36 or claim 37 which is for use in the food industry.

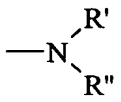
40. A method for sterilising fluids in which the fluid is contacted with a conjugate or composite formed between a compound of Formula I and a polymer whilst the conjugate or composite is illuminated.

41. A compound of Formula I



wherein:

A and B each independently is



in which R' and R'' each independently is a linear, branched or cyclic hydrocarbon group, or R' and R'' together with the N atom to which they are attached form an optionally substituted 5-, 6- or 7-membered ring;

and where X^{P-} is a counteranion and P is 1, 2 or 3;

except for the compounds in which A and B are the same and are selected from – $N(CH_3)_2$, $-N(CH_2CH_3)_2$, $N(n\text{-}Pr)_2$, $-N(n\text{-}Bu)_2$, $-N(n\text{-}Pent)_2$, $-N(n\text{-}Hex)_2$, $-N(n\text{-}Hept)_2$, piperidino, $-N(CH_2CH_2OH)_2$, $-N(diethylhexyl)_2$,

and not including those in which A is selected from $-N(Me)_2$ or $-N(Et)_2$ and B is selected from $-N(CH_2CH_2OH)_2$, piperidino, morpholino, thiomorpholino, $-N(Et)_2$, -N(MeEt), $-N(Me)_2$.

42. The following moieties:

3,7-(tetra-iso-pentylamino)-phenothiazin-5-ium;

3-(N,N-di-n-butylamino)-7-(N,N-di-n-propylamino)-phenothiazin-5-ium;

3-(N,N-di-n-hexylamino)-7-(N,N-di-n-propylamino)-phenothiazin-5-ium;

3-(2-ethylpiperidino)-7-(N,N-di-n-pentylamino)-phenothiazin-5-ium;

3-(2-methylpyrrolidino)-7-(N,N-di-n-pentylamino)-phenothiazin-5-ium;

3,7-(N,N-tetra- iso-butylamino)-phenothiazin-5-ium;

3-(N,N-di-n-butylamino)-7-(N,N-di-iso-pentylamino)-phenothiazin-5-ium;

3-(N,N-diethanolamino)-7-(N,N-di-n-pentylamino)-phenothiazin-5-ium;

3-(N,N-diethylamino)-7-(N,N-di-n-propylamino)-phenothiazin-5-ium;

3-(N,N-di-n-pentylamino)-7-(N,N-di-n-propylamino)-phenothiazin-5-ium;

3-(N,N-di-n-butylamino)-7-(N,N-di-n-pentylamino)-phenothiazin-5-ium; and

3-((N-ethyl-N-cyclohexyl) amino)-7((-N–ethyl)-N-cyclohexyl) amino-phenothiazin-5-ium;

in which the counteranions are selected from Cl^-, Br^- or I^-.